



## 10823 - The spectrum of a magnetar in the blue and ultraviolet.

Cycle: 15, Proposal Category: GO

(Availability Mode: SUPPORTED)

### INVESTIGATORS

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### VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
02	(1) CXOUJ010043.1-721134	WFPC2	6	08-Mar-2007 21:10:55.0	yes

6 Total Orbits Used

### ABSTRACT

Magnetars are natural laboratories for investigating the behaviour of matter at the very extremes of nature.

The magnetar CXOU J010043.1-721134 was serendipitously discovered by WFPC2 imaging of the SMC. Because of the low reddening to this source compared to the other magnetars, this is a unique opportunity to measure the spectral shape in the blue and ultraviolet. We hope also to establish the feasibility of spectroscopic follow-up. We are asking for two orbits of ACS imaging.

### OBSERVING DESCRIPTION

We will use two orbits with ACS to accurately measure CXOU J010043.1-721134's F606W magnitude (where the only detection has been made,  $m_{F606W} = 24.2$ ) and measure the source or set good limits across the optical/UV band, using filters F330W, F435W, and F814W. A Rayleigh-Jeans form spectrum ( $\nu F_\nu \sim \nu^n$ ,  $n = 3$ ) is possible given the limits in F814W previously obtained. Since it is very unlikely that the spectrum rises faster than this (it would require a very strong and broad spectral line), we predict a magnitude of  $m_{F814W} = 25$ . We can also predict what we might find in F435W by supposing that CXOU J010043.1-721134 has the same intrinsic B-V color as 4U 0142+61. With  $B-V = 2.5$  (Hulleman et al., 2004) and using our new estimated reddening for 4U 0142+61 ( $A_V = 3.5$ , Durant & van Kerkwijk, 2006, submitted), we find  $(B-V)_0 = 1.4$  and thus we would predict  $m_{F435W} = 25.7$ . For U we have no predictions, and hence for this initial study we will go as deep as possible in a single orbit. In the optical, with the WFC, a given SNR is reached much quicker than with the HRC. Only the HRC is sensitive in U, however, so we will use the WFC for one orbit and the HRC for the second. According to the ACS ETC for the WFC, 200s is required to reach  $SNR=20$  at  $V=24.2$  in F606W. Good measurements ( $SNR=10$ ) will be reached in F435W in 530s down to 25.3mag and in F814W in 860s down to 25.0mag, respectively. These all assume  $CR-SPLIT=2$ ,  $GAIN=2$  and average conditions. In total, these three filters will take 52min to observe, or one orbit exactly, including overheads. We will use the WFC1-1K sub-array to reduce the read-out time and release more time for exposures (and eliminate the buffer dump overhead).

In the second orbit, we will use the HRC to get as deep an image in F330W as possible. After accounting for overheads, 2550s remains, which reaches a detection limit ( $SNR=3$ ) of  $U=25.3$  for  $GAIN=2$ ,  $CR-SPLIT=2$ .

Proposal 10823 - Visit 02 - The spectrum of a magnetar in the blue and ultraviolet.

Fri Mar 09 02:11:02 GMT 2007

Visit	<b>Proposal 10823, Visit 02</b> <b>Diagnostic Status: No Diagnostics</b> Scientific Instruments: WFPC2 Special Requirements: ORIENT 20.0D TO 70.0 D; ORIENT 200.0D TO 250.0 D									
	Patterns	#	Primary Pattern	Secondary Pattern	Exposures					
	(1)	Pattern Type=WFPC2-LINE Purpose=DITHER Number Of Points=3 Point Spacing=0.354 Line Spacing=	Coordinate Frame=POS-TARG Pattern Orientation=45 Angle Between Sides= Center Pattern=false		(1)					
Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous				
	(1)	CXOUJ010043.1-721134	RA: 01 00 43.1090 (15.1796208d) Dec: -72 11 33.77 (-72.19271d) Equinox: J2000		V=24.2+/-0.2 m606-m814 < -0.3	Reference Frame: ICRS				
Exposures	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	1		(1) CXOUJ010043.1-721134	WFPC2, IMAGE, WF3	F336W	CLOCKS=YES		Pattern 1-1 (1)	2600.0 Secs	
									[==>1400.0 Secs (Pattern 1, Split 1)]	[1]
									[==>(Pattern 1, Split 2)]	
									[==>(Pattern 2, Split 1)]	
									[==>1400.0 Secs (Pattern 2, Split 2)]	[2]
									[==>1400.0 Secs (Pattern 3, Split 1)]	
									[==>(Pattern 3, Split 2)]	[3]
	2		(1) CXOUJ010043.1-721134	WFPC2, IMAGE, WF3	F439W	CLOCKS=YES			1000.0 Secs	
									[==>500.0 Secs (Split 1)]	[4]
								[==>500.0 Secs (Split 2)]		
3		(1) CXOUJ010043.1-721134	WFPC2, IMAGE, WF3	F439W	CLOCKS=YES		SAME POS AS 5	1200.0 Secs		
								[==>500.0 Secs (Split 1)]	[4]	
								[==>800.0 Secs (Split 2)]		
4		(1) CXOUJ010043.1-721134	WFPC2, IMAGE, WF3	F439W	CLOCKS=YES		POS TARG 0.5,0.5	1000.0 Secs		
								[==>700.0 Secs (Split 1)]	[5]	
								[==>400.0 Secs (Split 2)]		
5		(1) CXOUJ010043.1-721134	WFPC2, IMAGE, WF3	F814W	CLOCKS=YES		POS TARG 0.5,0.5	1200.0 Secs		
								[==>500.0 Secs (Split 1)]		
								[==>700.0 Secs (Split 2)]	[5]	

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Exposures (continued)	#	Label	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time/[Actual Dur.]	Orbit
	6		(1) CXOUJ010043.1 -721134	WFPC2, IMAGE, WF3	F814W	CLOCKS=YES	POS TARG 0.25,0.2 5		1400.0 Secs [==>700.0 Secs (Split 1)] [==>700.0 Secs (Split 2)]	[6]
	7		(1) CXOUJ010043.1 -721134	WFPC2, IMAGE, WF3	F606W	CLOCKS=YES; CR-SPLIT=NO	POS TARG 0.25,0.2 5		400.0 Secs [==>]	[6]
	8		(1) CXOUJ010043.1 -721134	WFPC2, IMAGE, WF3	F606W	CLOCKS=YES; CR-SPLIT=NO			400.0 Secs [==>]	[6]







